

# MONTHLY WEATHER REVIEW,

FEBRUARY, 1878.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

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## INTRODUCTION.

In compiling the present Review the following data received up to March 14th, have been made use of viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and twenty-eight Signal Service stations and twelve Canadian stations: monthly journals and means from one hundred and thirty-eight of the former, and means from fourteen of the latter; two hundred and fifty-nine reports from voluntary observers; thirty-six monthly reports from United States Army Post Surgeons; Marine records; International Simultaneous Reports; Monthly Reports of the Weather Services of the States of Iowa and Missouri; reliable newspaper extracts and special reports. The most interesting features of the month have been, 1st: The general deficiency in pressure, which has been the most marked in Washington Territory, Oregon, the Gulf and South Atlantic States. 2nd, The continued high temperatures in the Upper Mississippi and Lower Missouri valleys. 3rd, The large number of low areas traced from the Pacific. 4th, The severe storm of the 20th, 21st, 22nd and 23rd, (No. XI). 5th, The general deficiency in precipitation east of the Rocky Mountains, and excessive rain-falls on the Pacific coast, and consequent destructive floods. 6th, The remarkable measured wind-velocity of 150 miles per hour at Mt. Washington. 7th, The tornadoes from the 7th to the 9th. 8th, The severe thunder-storms of the 20th. 9th, The forward state of vegetation in the Western States.

## BAROMETRIC PRESSURE.

*In General.*—The general distribution of atmospheric pressure is shown by the isobars on chart No. II. A comparison with the means for former years show that the pressures have been, in general, below the normal, and that this deficiency is very marked on the North Pacific slope and in the Gulf and South Atlantic States. In Oregon there is a deficiency of 25 hundredths of an inch, and in the latter two districts of 12 to 15 hundredths of an inch.

*Barometric Ranges.*—The largest and smallest ranges have been respectively as follows: California—Red Bluff, 1.01; Los Angeles, 0.75. Rocky Mountains—Denver, 0.82; Pike's Peak, 0.60. Northwest—Yankton, 1.19; Deadwood, 0.82. The Southwest—Concho, 1.41; Stockton, 0.74. Upper Mississippi Valley—St. Louis, 1.31; Dubuque, 1.08. Upper Lakes—Chicago, 1.17; Marquette, 0.90; Lower Lakes—Detroit and Toledo, 1.16; Oswego, 0.94; Ohio valley and Tennessee—Cairo, 1.33; Knoxville, 1.03. East Gulf States—Vicksburg, 1.12; St. Marks, 0.73. South Atlantic States—Augusta, 0.83; Jacksonville, 0.68. Middle Atlantic States—Ft. Whipple, 1.03; Cape May, 0.89. New England—Eastport, 1.26; Burlington, 0.86.

*Areas of High Barometer in General.*—These have been unimportant, furnishing a great contrast to the conditions for February of former years. The consequent absence of cold northerly gales has given the country generally a month of remarkably mild weather, especially in the Upper Mississippi and Lower Missouri valleys.

No. I.—On morning of 1st this area of high pressure covered a small section of the Northwest, evidently advancing from Manitoba. At midnight of 1st it was central at Pembina, barometer, 30.43, (0.30 above normal,) clear, cool weather, calms or light winds. On morning of 2d, accompanied by marked fall of temperature, the ridge of high pressure spreading eastward has extended its limits from Dakota to St. Lawrence valley, being central at Escanaba, barometer, 30.42, (0.40 above normal.) During 2d, clear weather, with calms or light northerly winds, prevailed from Minnesota to New York. On morning of 3rd the central

pressure had slightly decreased and a ridge of equal pressure, with generally clear and cold weather, extended from northern Texas to northern New York, with highest barometer, 30.45, at Port Stanley, Oswego, (0.30 above normal.) During afternoon of 3d the central portion disappeared off the New York coast.

No. II.—This area developing in Montana on 1st, reached Utah on morning of 2d; Salt Lake City, barometer, 30.34, (0.40 above normal.) Reaching Santa Fe, afternoon of 3d, on morning of 4th it had advanced to central Texas, accompanied by clear, cold weather; Indianola, barometer, 30.34. Morning of 5th reached Alabama, with slightly increasing pressure. It was central in North Carolina on morning of 6th, with clear, calm and colder weather; barometer at Wilmington, 30.33. Knoxville 0.23 above normal. That night it disappeared off the North Carolina coast.

No. III.—Appearing in Manitoba on morning 8th; by midnight the barometer at Fort Garry read 30.46. It remained nearly stationary in Minnesota until afternoon of 9th, when it was gradually dissipated by the influence of storm No. V.

No. IV.—This area of high pressure first appeared in SE. Texas on afternoon 10th; clear weather, with brisk, northerly winds, gradually diminishing to calms, prevailed that day; morning 11th, highest pressure noted at Indianola, 30.33; afternoon 11th, it was central at New Orleans, bar. 30.22. At midnight it was central in Alabama, reaching Georgia morning 12th, and disappeared off Georgia coast that evening.

No. V.—This area was first made manifest in clear, cold weather, and rising barometer in Northwest, morning 12th. It first defined itself on the Signal Service maps in St. Lawrence valley at midnight 13th, remaining nearly stationary until morning 14th, with clear weather and low temperatures. Rockliffe, bar. 30.26; ther.  $-11^{\circ}$ . Montreal and Burlington, bar. 0.14 above normal. It was central over Nova Scotia morning 15th, when it disappeared.

No. VI.—This pressure first showed itself above the normal in Alabama morning 16th, and disappeared off the North Carolina coast, forenoon 17th.

No. VII.—This area first defined itself in Minnesota morning 17th, and, at midnight, was central over Michigan, with light northerly winds. Escanaba bar. 30.24. On morning 18th, central over Lake Huron; Saugeen bar. 30.33, 0.25 above normal. Traveling in SSE. direction across New York, the centre, morning 19th, was over Maryland; Washington bar. 30.37, Washington and Philadelphia bar. 0.23 above normal. Clear weather, with fresh northerly winds, prevailed along coast from New England to South Carolina. The area passed off the coast of Delaware evening of 19th.

No. VIII.—This area, morning 21st, was in Quebec. Father Point, bar. 30.20, Chatham, 0.26 above normal. Cold, clear weather, with brisk to high northerly winds prevailed; centre at midnight at Chatham, bar. 30.56, or 0.68 above normal. Highest pressure was morning 2d, Chatham, bar. 30.67, or 0.78 above normal, with temperature  $-9^{\circ}$ . On afternoon highest pressure was central over Nova Scotia; Sydney bar. 30.64, or 0.77 above normal, disappearing next morning off the coast of Newfoundland.

No. IX.—This area probably developed north of Montana, as shown by continued high barometer from morning 22d till afternoon 23d, when it appeared in Manitoba, where the pressure steadily increased till morning 24th; Ft. Garry bar. 30.27. It moved south down the Missouri valley, and on morning 25th the isobar of 30.30 included this country from Alabama to Dakota, with highest pressure central in Missouri. Morning 26th it was central in Illinois, highest bar., Davenport, 30.55, 0.41 above normal. Clear weather, with light northerly winds, prevailed from Dakota to South Carolina, and from Alabama to Lower Lakes. Morning 27th it was central over Ohio, Sandusky bar. 30.32, Toledo bar. 0.24 above normal. Clear weather prevailed east of Rocky Mountains, save in Gulf and South Atlantic States, which were affected by low area No. XII. Moving south, with diminishing pressure, it disappeared, afternoon 28th, in Alabama.

No. X.—Appears to have formed in Manitoba country, first showing itself morning 28th at Pembina, being central that afternoon over Upper Lakes. At midnight, 28th, with increasing pressure, it was central in Quebec; Rockliffe bar. 30.51, Parry Sound bar. 0.35 above normal.

*Areas of Low Barometer in General.*—Eleven areas of low pressure are traced upon chart No. I. Low areas Nos. VIII and X are not charted. They are divisible into two groups, viz: Nos. II, IV, V, VI, XI, XII and XIII appeared first on the Pacific coast, and thence moved in a southeasterly track over the Rocky Mountains. The others all first appeared east of the Rocky Mountains.

The storm described as low area No. XII in the January REVIEW continued as a severe northeast gale on the 1st along the Middle Atlantic and New England coasts, gradually diminishing in energy during the day. The following maximum velocities are reported for this storm on the 1st: New Haven, 40 miles, NE.; Boston, 53 miles, N.; Thatcher's Island, 60 miles, NE., and Portland, 40 miles, NE.

No. I.—A low pressure was developed on the morning of the 1st in the West Gulf States. On the 1st and 2nd, accompanied by brisk winds and light rain in the Gulf and South Atlantic States, it moved in a southeasterly path into the East Gulf. On the 3rd it advanced over Florida, and thence pursuing a track nearly parallel to the Gulf stream, it gave rise, on the 4th, to the high winds and heavy rain that prevailed in the South Atlantic States on that day.

No. II.—This depression can be traced from the Pacific. On the 4th there was a rapid fall of the barometer in Oregon, and severe southerly gales prevailed on the Pacific coast on that day. The centre of the low area moved to the southeast, and on the morning of the 5th the lowest pressure was in Wyoming, and thence the low area pursued its southeasterly path, and by the morning of the 6th had developed into a storm of considerable energy, central in northwest Texas. At the a. m. report of the 7th the lowest barometer, 29.49 or 0.65 below the normal, was at Shreveport, La., with the highest pressure in the Middle States. At this time high southeast winds and heavy rains were reported from the East Gulf States, while in Texas the winds had veered to northwest, with colder, clearing weather and rising barometer. The storm, rapidly increasing in energy, had moved by the morning of the 8th into the Ohio valley, where the isobar of 29.30 included both Cincinnati and Louisville, the barometer at the latter place being 0.79 below the normal. On this day there were wind velocities reported from Escanaba of 40 miles, N., and from Cape Lookout 60 miles, SW. The storm-centre then moved, with slightly diminishing energy, over the Middle States, and the wind directions show that, on the morning of the 9th, it had passed beyond the New England coast.

No. III.—This apparently was a subsidiary low area developed from the great depression No. II that crossed from the Pacific ocean. On the morning of the 5th the centre was in Dakota; thence the depression moved slowly to the eastward over Lake Superior, attended by light or brisk southeast winds, veering to colder northwesterly, and occasional light rain or snow, until, on the 7th, it disappeared north of Lake Huron.

No. IV.—This depression is traced from the Pacific. From midnight to the morning of the 6th a rapid fall of the mercury occurred on that coast, and heavy rain or snow fell on that and the succeeding day on the slope west of the Rocky Mountains. At the a. m. report of the 7th the barometer was lowest near Salt Lake. On this day the maximum wind velocity for the month was recorded at Pike's Peak—75 miles, N. The depression moved very rapidly in a southeasterly path, and the morning of the 8th showed a low area in northwest Texas. During the day this depression moved slowly to the east, and during the night to the northeast, and by the morning of the 9th was central in Tennessee and the Ohio valley, the barometer at Louisville, 29.25, being 0.78 below the normal. On the 9th it moved to the east, giving rise, in connection with the rising barometer in the Upper Lakes, to high northeasterly gales in the Lake region. On the 10th the storm-centre passed over New England, where a northeast wind of 44 miles is noted at Eastport, and on the 11th the storm moved beyond Nova Scotia.

No. V.—This low area is traced from the Pacific. The barometer fell rapidly on the Pacific slope on the 11th, and very severe gales, with heavy rain, were reported from that coast on that day. On the morning of the 12th the depression was central in Utah, and then advancing rapidly in a southeasterly track, the low area was, at the a. m. report of the 13th, central in the Indian Territory. During the day thunderstorms were reported from the Gulf States. On the 13th and 14th the low area gradually extended, with frequent rains, over the South and Southwest; but there appears to have been no well-defined storm-centre. On the morning of the 15th a trough of low pressure extended from Lake Erie to the Gulf of Mexico, and during the day this depression was filled up by the inflowing air.

No. VI.—This depression is also traced from the Pacific. The a. m. report of the 13th showed a rapid fall in the mercury in California and Oregon, with heavy rain and high southerly gales. The low area moved, with diminishing energy, in a southeasterly track, and was last noted as an independent depression at the midnight report of the 13th, when it was central in Utah.

No. VII.—On the 13th there was a considerable fall of pressure in Florida and Cuba, accompanied by brisk easterly winds, heavy and frequent rains, with occasional thunderstorms. On the 14th the depression traversed Florida in an easterly track, and was rapidly followed by clearing weather and westerly winds.

No. VIII.—A storm of considerable energy prevailed, with high southerly winds and heavy rain, on the Pacific coast on the 14th. The depression moved, with diminished energy, eastward to the Rocky Mountains, and was there filled up by the inflowing air. Its path was too uncertain to be charted.

No. IX.—On the 15th the barometer fell slowly in the Northwest, and the centre of the low area thus developed moved on the 16th into Wisconsin. On the 17th it advanced over the Lower Lake region and Middle States, and by the a. m. report of the 18th it had gone beyond the New England coast. In its passage it was accompanied by brisk but not high winds, and frequent but light rain fell to the south of its track and light snow to the north.

No. X.—During the night of the 15th and 16th there was a rapid fall of the mercury on the Pacific coast, with severe southerly gales and heavy rain. The storm was followed by rapidly rising barometer. Its track was too indefinite to be charted.

No. XI.—This depression is traced from the Pacific. On the 17th there was a decided fall in the barometer in Washington Ty. On the 18th the fall had extended to the Northwest. On the 19th the centre of the depression moved in a southerly track into Missouri. On the 20th the lowest pressure was transferred to the Indian Ty. On that day the storm increased very rapidly in energy. Several thunderstorms were reported from the Gulf States and Tennessee, while the rain-area extended over the Ohio valley, Lake region and the Middle States, with snow in New England. The same day the pressure fell 0.93 below the normal at Fort Gibson, and more than 0.80 below the normal at Ft. Sill, Denison, Corsicana, Shreveport and Memphis. On the 21st, the storm still increasing in energy, became central in the Ohio valley, and on the same day the barometer rose very rapidly in New England and Nova Scotia. The pressure at the cen-



tre of the depression continued during the day below 29.20, and the following pressures were noted below the normal: Memphis, 0.92; Cairo, 0.89; Louisville, 0.85. The morning report of the 22d shows the lowest pressure in Indiana, with the barometer still rapidly rising in Nova Scotia. At this time the isobar of 30.60, with an average temperature of  $+10^{\circ}$  extended from Father Point, Can., slightly to the east of Eastport, Me., the isobar of 29.60 with an average temperature of  $+50^{\circ}$  extended from Baltimore, Md., to Erie, Pa. Both the temperature and pressure gradient indicated the severe gales that were felt on the New England and Middle Atlantic coasts on that day. At the a. m. report of the 23rd the centre of the low area had moved into Canada near the Georgian Bay. It then advanced with rapidly diminishing energy in an easterly path, into Nova Scotia and disappeared on the 24th beyond that coast. This was an unusually severe storm, and during its passage from the Pacific to the Atlantic the following high velocities are reported: 17th, Red Bluff, Cal., 44 miles, SE.; 20th Dodge City, Kan., 60 miles N.; Stockton, Tex., 52 miles W.; New Orleans, 40 miles SE.; Mobile, 42 miles SE.; 22nd, New London, Conn., 80 miles E.; 26th, Mt. Washington, 150 miles N.

No. XII.—On the 23rd the mercury fell in Oregon, with southerly winds and frequent rains; the centre of the low area moved in a southerly track along the coast, and at midnight of the 24th it was near San Diego, Cal. On the 25th it moved rapidly in a southeasterly track, and at the a. m. report of the 26th, the centre of the low area was situated to the south of Brownsville, Texas. On the 26th it moved over the Gulf in an easterly track, and was accompanied in the Gulf States by easterly winds backing to northwest. On the morning of the 27th it was central in southern Florida, and on that day moved to the east beyond the coast. The rain-fall in southern Florida was excessive. During its passage the following maximum wind velocity was reported: 22nd, Indianola, Tex., 84 miles N.

No. XIII.—On the 25th and 26th there was a general fall of pressure on the Pacific coast, with heavy rain and southerly gales. On the 27th the centre of the low area had moved into Utah, and on the 28th, still pursuing a southeasterly track, it had advanced into Texas.

As illustrating the service of the telegraph lines of the Signal Service and the signal stations established along the lines, equipped, as they are, for communicating with vessels in either the International Code or Signal Service Code, it may be stated that the Italian bark *Giuseppe Massano*, Captain Meretto, ran ashore near Cape Henry, Va., and was reported to the Signal Station at 6:55 a. m. of the 10th. Information was at once sent to the Chief Signal Officer at Washington, and assistance thence asked from Norfolk. It was attempted by Cape Henry station to open communication by means of the flags of the International Code, but receiving no response from the ship, Private Harrison, fully equipped with flags, etc., of the Signal Service apparatus, was sent aboard to open communication with the shore, which he did with very good result. The following appears in the report of Sergeant Bell, in charge of Signal Station at Cape Henry: "At one time during the morning, (11:30 a. m.) when the crew abandoned the vessel, and the captain and first mate were preparing to abandon her, Private Harrison informed the captain that he should have more confidence in his signaling, and that by this means he would keep him fully informed of all particulars from shore, which eventually proved the means of saving the ship from total loss, and she was subsequently removed with but slight damage by the wrecking steamer from Norfolk, summoned by means of the coast lines. Again near Cape Hatteras on the 22nd, a vessel was noticed flying a signal of distress. An unsuccessful effort was made to open communication with her by means of the flags of the International Code. The life-saving station, twelve miles distant, was notified by messenger. Later in the day, and before assistance could reach her, the vessel drifted out to sea. Information had been sent as soon as the distress-signal was noticed to Norfolk by means of the sea-coast telegraph line, and the United States revenue-cutter *Hamilton*, Captain Irish, sailed to her rescue from that port. This revenue-cutter arrived off Hatteras Signal Station the next morning, and without landing opened communication with that station by the Signal Service Code—by which messages of any character may be communicated—learned all particulars in reference to direction in which vessel was last seen and other matters in reference to her, steamed to sea in search, and found two days later the schooner *H. C. Cushing*, of Boston, abandoned and in a sinking condition, near the Gulf Stream.

### INTERNATIONAL METEOROLOGY.

October 7th to 12th, great storm along the entire coast of China, followed by extraordinary cold NW. winds. 14th, latitude  $43^{\circ} 30' N.$ ,  $60^{\circ} W.$ , hurricane, WNW. to W., lasting 12 hours, with lightning and heavy rain. 16th, off Cape of Good Hope, heavy SW. gale. 21st,  $29^{\circ} 24' N.$ ,  $132^{\circ} E.$ , gale. 22d,  $54^{\circ} 14' S.$ ,  $76^{\circ} 14' W.$ , gale. November 5th,  $34^{\circ} N.$ ,  $136^{\circ} E.$ , gale. 20th, off Cape of Good Hope, gale. 22d,  $43^{\circ} 4' N.$ ,  $125^{\circ} W.$ , gale. 23d,  $46^{\circ} 49' N.$ ,  $125^{\circ} W.$ , gale. December 10th, between Tortugas and Cape Florida light, heavy NE. gale; latitude  $44^{\circ} 7' S.$ , longitude  $30^{\circ} 57' W.$ , terrific gale, with tremendous sea. 23d, off island of Grand Cayman, Caribbean sea, NW. gale. 26th,  $36^{\circ} 25' N.$ ,  $2^{\circ} 5' W.$ , heavy gale; off coast of Chili, gale. 30th, 20 miles SE. off Hatteras, terrific NNW. gale, lasting 3 days. January 1st, heavy gale off St. Catharine, Bermudas. 5th,  $17^{\circ} 21' N.$ ,  $58^{\circ} 36' W.$ , hurricane. 6th,  $25^{\circ} 33' N.$ ,  $72^{\circ} 71' W.$ , heavy NE. gale, lasting 20 hours. 10th,  $30^{\circ} 35' N.$ ,  $74^{\circ} W.$ , hurricane from SE., lasting 7 hours. 11th,  $38^{\circ} N.$ ,  $70^{\circ}$  to  $72^{\circ} W.$ , hurricane SE. to N., lasting 7 hours;  $37^{\circ} 02' S.$ ,  $22^{\circ} 43' E.$ , very heavy W. gale, lasting 12 hours. 13th,  $40^{\circ} 38' N.$ ,  $68^{\circ} 52' W.$ , strong WNW. gale. 14th,  $37^{\circ} 71' N.$ ,  $71^{\circ} W.$ , hurricane from SE. to SW. 19th,  $30^{\circ} N.$ ,  $50^{\circ} W.$ , heavy gale from SE. to N.; about  $30^{\circ} N.$ ,  $50^{\circ} W.$ , hurricane from SSE., lasting 24 hours. 23d,  $50^{\circ} 13' N.$ ,  $22^{\circ} W.$ , strong WNW. gale;  $45^{\circ} N.$ ,  $163^{\circ} W.$ , hurricane winds for 2 hours, barometer 28.34; British Isles, gales. 24th,  $50^{\circ} 10' N.$ ,  $26^{\circ} 48' W.$ , and  $49^{\circ} 38' N.$ ,  $26^{\circ} 17' W.$ , strong WNW. gales;  $49^{\circ} 40' N.$ ,  $7^{\circ} 22' W.$ , NW. gale, with heavy squalls and hail;  $44^{\circ} 03' N.$ ,  $56^{\circ} 11' W.$ , strong

WSW. gale, barometer 29.90. 28th, 54° 53' N., 14° 20' W. fierce NW. squalls, with hail and rain; 49° 08' N., 16° 49' W., NW. fresh gale and hard squalls; 28° N., 70° W., heavy W. gale veering to NE., lasting 24 hours. 30th, 30 miles E. of Cape May violent E. gale; 32° 54' N., 77° 32' W., gale from SE., hauling to W. and NW., lasting 3 days. 31st, 40° 34' N., 70° 50' W., strong NE. gale and heavy snow-storm; 44° 40' N., 44° 56' W., thunder-storm from SW., followed by heavy NW. gale; 40° N., 73° 25' W., gale from E., with snow; 35° 03' N., 66° W., noon, heavy SE. gale veering to SW.; midnight, NW. gale, lasting until February 2d; 34° 26' N., 75° 50' W., heavy ESE. gale, lasting 24 hours; 100 miles E. of Sandy Hook. E. to SE. hurricane, lasting 12 hours; 37° N., 75° W., gale ENE., tremendous sea; about 49° 30' N., 5° W., strong S. gale veering to W., followed February 1st by very high sea. February 1st, 40° N., 73° 25' W., gale NE. and snow; 43° 21' N., 50° 07' W., 46° 44' N., 48° 10' W., 47° 28' N., 38° 31' W., and 49° 38' N., 40° 26' W., heavy NW. gales and seas; 46° 14' N., 40° 17' W., furious SW. to NW. gale, immense sea; 47° 41' N., 37° 36' W., strong SW. gale, with hard squalls. 2nd, 44° 48' N., 44° 51' W., gale. 4th, 49° 37' N., 31° 19' W., strong S. gale, with high sea. 5th, 54° 31' N., 18° 54' W., strong WSW. gale and hard squalls; 34° 29' N., 23° 13' W., heavy SW. gale, veering to NW., lasting 24 hours; off the Banks of Newfoundland, terrible E. snow-storm, with tremendous sea; 49° N., 55° W., heavy gale. 6th, 44° 11' N., 53° 27' W., strong gale from SE. to NW.; 42° 40' N., 52° 02' W., strong SW. gale; 28° 04' N., 60° 31' W., terrific squalls, followed by NW. gale, lasting through the 7th; 54° 02' N., 26° 04' W., hard SSW. gale; 46° 29' N., 43° 02' W., and 50° 23' N., 19° 13' W., strong S. gale; 46° 53' N., 34° 26' W., heavy SE. gale; 40° N., 42° W., hurricane, with terrific cross-seas. 7th, 44° 25' N., 53° W., hurricane from N.; 46° N., 44° W., hurricane, SW. to NW.; 43° 14' N., 56° 32' W., strong NNW. gale; 41° 54' N., 54° 56' W., very heavy W. gale; 45° 13' N., 45° 54' W., strong gale. 8th, 42° 30' N., 60° 08' W., and 43° 53' N., 48° 38' W., strong NW. gales. 9th, 45° 02' N., 44° 50' W., heavy NW. gale and very high seas. 10th, 33° 22' N., 68° 07' W., gale from ENE.; 44° 32' N., 48° 08' W., strong WNW. gale. 11th, 35° 40' N., 73° 35' W., heavy WSW. gale. 13th, 44° 29' N., 47° 41' W., strong NW. gale; 46° 36' N., 38° 07' W., heavy NW. gale, with violent squalls and snow. 14th, 45° 06' N., 41° 52' W., heavy NW. gale and hail-squalls; 47° 13' N., 38° 04' W., hard SSW. to WNW. gale; 50° 30' N., 36° 42' W., violent NNW. gale, fierce squalls, snow and sleet; 48° 53' N., 36° 02' W., heavy NW. gale; 48° 55' N., 34° 33' W., strong and violent S. to NNW. gales, with terrific squalls and high, confused sea. 15th 35° N., 67° W., S. gale; 44° 02' N., 44° 50' W., 45° 35' N., 42° 25' W., 48° 49' N., 38° 47' W., and 48° 26' N. 38° 01' W., hard NW. and W. gales, with fierce squalls, snow and sleet. 16th, 47° 21' N., 42° 15' W., 50° 17' N., 29° 21' W., and 49° 5' N., 26° 34' W., strong NW. to SW., gales, with hard snow-squalls. 17th, 48° 57' N., 35° 28' W., and 49° 29' N., 31° 55' W., strong NW. gales, with heavy squalls; 55° 20' N., 9° 21' W., and 55° 25' N., 9° 48' W., strong southerly gales. 18th, 47° 69' W., NNE. gale, lasting 36 hours; 46° 43' N., 40° 41' W., violent gales, (W.-E.-N.); 48° 45' N., 39° 08' W., strong SW. to SE. gale; 55° 18' N., 13° 11' W., strong NW. to SW. gale; 50° 37' N., 27° 40' W., heavy NW., to S. gale. 19th, 32° N., 73° W., violent NW. and SE. gales, with heavy rain; 42° 12' N., 64° 28' W., N. gale; 44° 47' N., 45° 26' W. violent NW. to SSW. gale; 47° 20' N., 42° 59' W., hurricane-like gale from NE. to W., with tremendous sea; 54° 23' N., 19° 21' W., severe NW. gale, high sea; 50° 05' N., 20° 32' W., and 49° 40' N., 19° 42' W., heavy SW. gales; 25° N., 63° W., heavy SW. to NW. gale, lasting 12 hours. 20th, 43° 37' N., 48° 56' W., violent to moderate SSW. to NW. gale; 46° 21' N., 49° 28' W., strong SSW. to NNW. gale; 53° 51' N., 22° 09' W., hard WNW. to WSW. gale; 50° 56' N., 27° 37' W., hard NW. gale, with terrific squalls; 49° 42' N., 26° 55' W., heavy westerly storm; 49° 34' N., 21° 27' W., strong SW. to NW. gale with heavy squalls. 21st, 52° 54' N., 26° 20' W., and 49° 17' N., 25° 26' W., strong SW. gales; 48° 07' N., 35° 57' W., hurricane from W., with very heavy sea. 22nd, 36° N., 72° W., violent SE. gale, lasting 48 hours; 52° 34' N., 29° 17' W., 48° 05' N., 34° 30' W., 48° 31' N., 37° 52' W., and 48° 37' N., 37° 51' W., strong and hard W. to SW. gales; 28° N., 79° W., heavy NNW. gale and sea, lasting 12 hours. 23rd, two hundred and fifty miles SW. of Bermuda, heavy NW. gale; 47° 49' N., 35° 34' W., furious E. gale, with violent squalls and constant heavy rain. 24th, 49° 12' N., 41° 04' W., strong ENE. gale; 43° N., 53° 21' W., SE. gale; 45° 04' N., 41° 12' W., violent NE. storm, mountainous sea. 25th, 37° N., 73° 40' W., heavy NW. gale, lasting 48 hours. 26th, 43° 26' N., 48° 34' W., heavy NE. squalls, with heavy rain and snow. 27th, 43° 39' N., 56° 40' W., 45° N., 45° 36' W., and 35° 53' N., 71° 52' W., heavy NW. gales.

## TEMPERATURE OF THE AIR.

*In General.*—The general distribution of the temperature of the air is shown by the isotherms on chart No. II. By reference to the table of comparative temperatures, in the left-hand corner of same chart, it will be seen that the high temperatures existing during January have continued, in a still more marked degree, throughout the present month. The largest deviation occurs in Minnesota, where the mean temperature of four stations is 18°.7 above the normal. In the Missouri and Upper Mississippi valleys and Upper Lake region the excess is from 9° to 16°; thence eastward to the Atlantic coast and St. Lawrence valley from 4° to 5°, and from the Ohio valley to the Gulf coast and in the Rocky mountain region from 2° to 3°. In the Pacific and South Atlantic coast States the excess is quite small.

*Monthly mean temperatures at special points* have been as follows: Pike's Peak, 2°.5; Mt. Washington, 10°.2.

*Maximum and Minimum Temperatures.*—Maximum temperatures, at Signal Service and voluntary stations above 70°, are reported as follows: 85° at Flatonia, Fla.; 81° at Fredericksburg, Tex.; 80° at Stockton, Concho, Fort Griffin, Fort McKavitt, Tex., and Okahumpka, Fla.; 79° at Mason, Tex.; 78° at Jacks-

boro' and Austin, Tex.; 77° at Fort Sill, Ind. Ter.; 76° at Decatur, Tex., South Pueblo, Col., and Daytona, Fla.; 75° at Oglethorpe Barracks, Ga., Clarksville, Tex., and Savannah, Ga.; 74° at Huston, and Jacksonville, Fla.; Quitman, Ga., and Belmont Farm, Tex.; 73° at Weldon, N. C.; 72° at Great Bend and Kingsly, Kan., Fort Barrancas, Fla., Judsonia, Ark., Alto Vista, Va., and Cape Henry; 71° at Augusta, Wilmington, Los Angeles, New Orleans and Fort Monroe, Va.

*Minimum Temperatures*, at Signal Service and voluntary stations, were: —22° at Woodstock, Vt.; —20° at Newport, Vt., and Nile, N. Y.; —19° at Pikes Peak; —18° at Summit, Col., and Billerica, Mass.; —17° at Mt. Washington and Waterbury, N. Y.; —16° at Fort Garland, Col., Cooperstown, N. Y., Orono, Me., and Westboro, Mass.; —15° at Fort Sanders, Wy. Ter., and Dumbarton, N. H.; —14° at Tioga, Pa., Dudley, Col., Detroit, Mich., and Cazenovia, N. Y.; —13° at Wappinger's Falls, N. Y., and Lunenburg, Vt.; —11° at Contoocookville, N. H., and Williamsport, Pa.; —10° at West Waterville, Me., and Palermo, N. Y.; —8° at Waltham, Mass., Franklin, Pa., Mechanic's Falls, Me., Plattsburg Barracks, N. Y., and Fort Fred. Steele, Wy. Ter.; —7° at Albany, N. Y.

*Ranges of Temperature*.—Largest monthly and diurnal ranges have been, respectively, as follows: Cheyenne, monthly, 64°, diurnal, 44°; Griffin, 61° and 47°; Stockton, 61° and 46°; McKavitt, 61° and 43°; Yankton, 59° and 32°; Jacksboro', 57° and 41°; Mason, 57° and 40°; Cleveland, 56° and 27°; Breckenridge, 55° and 38°; Fort Sill, 55° and 40°; North Platte, 54° and 36°; Omaha, 52° and 27°; Dodge City, 52° and 37°; Pembina, 52° and 38°; St. Paul, 52° and 32°; Oswego, 52° and 35°; Boston, 52° and 34°.

*Small monthly and diurnal ranges* have been as follows: San Francisco, 20° and 13°; Sacramento, 21° and 16°; Red Bluff, 25° and 22°; Cape Hatteras, 28° and 21°; Boise City, 29° and 21°; Visalia, 30° and 24°; Los Angeles, 30° and 23°; Cape Lookout, 31° and 20°; Indianola, 32° and 23°; Galveston, 33° and 16°; Cairo, 33° and 24°; Smithville, 33° and 25°; Charleston, 35° and 20°; Cape May and Sandy Hook, 36° and 18°; Wood's Holl, 35° and 21°.

*Frosts* have been reported nearly every day in the Northwest, Lake region and northern portion of New England; and in the other sections east of the Rocky Mountains, generally from the 1st to the 6th, 11th to 13th, on the 19th and 20 and from the 26th to the 28th.

*Ice* is reported to have formed as follows: In Kansas from the 1st to the 4th, 9th to 12th, and on the 24th; in Texas on the 11th; Mississippi, 1st, 5th, 11th and 12th; Florida, 12th; New Jersey, 7th and 18th, and in Massachusetts on the 21st.

## PRECIPITATION.

*In General*.—The general distribution of rain (and melted snow) for the month, is shown on Chart No. III. By reference to the table in the lower left hand corner of same Chart, it will be seen that there has been a very large excess in the Pacific coast States, and a general deficiency east of the Rocky Mountains, which is most marked in Tennessee, the Ohio valley, East Gulf and Middle Atlantic States. In the Lower Lake region and New England, a small excess is occurs. The heavy rains in the Pacific States, resulted in extensive flows, of which a short account is given below.

*Special Heavy Rains*.—1st, Westboro, Mass., 2.39 inches. 6th, Baton Rouge Barracks, La., 1.85 in.; New Orleans, La., (6th and 7th) 2.08 in.; Denison, Tex., (6th and 7th,) 2.27 in.; Corsicana, Tex.; (6th and 7th) 2.22 in. 14th, Spring Garden, Tenn., (14 and 15th) 2.40 in.; Red Bluff, Cal., (13 and 14th) 3.25 in. 15th, Los Angeles, Cal., 1.78 in.; Santa Cruz, Cal., 1.70 in. 17th, Red Bluff, Cal.; 2.41 in.; San Francisco, Cal., 1.92 in.; 20th, Red Bluff, Cal., 2.02 in.; Fort Gibson, Ind. Ty., 2.06 in. 22nd, New York City, 2.11 in.; New Haven, Conn., 4.13 in.; Springfield, Mass., 2.20 in.; Westboro, Mass., 2.51 in.; West Chester, Pa., 2.36 in.; Green Castle, Pa., (21st and 22nd) 2.07 in.; Thatcher's Island, Mass., 3.01 in.; Fort Preble, Me., 3.30 in.; Alpena, Mich.; (21st and 22d) 2.34 in.; Wilmington, N. C., (21st and 22) 2.26 in. 25th, Fort Duncan, Tex., 1.80 in.; Red Bluff, 1.99 in.

*Large Monthly Rain-falls*.—At Red Bluff, Cal., 16.66 in.; Santa Cruz, Cal., 16.04 in.; Olympia, Wash. Ty., 15.50 in.; San Francisco, Cal., 12.52 in.; Portland, Or., 12.16 in.; Okahumpka, Fla., 10.80 in.; Salinas, Cal., 8.77 in.; Sacramento, Cal., 8.07 in.; Los Angeles, Cal., 7.68 in.; Daytona, Fla., 7.64 in.; Roseburg, Or., 7.30 in.; Cambridge, Mass., 6.59 in.; New Haven, Conn., 6.40 in.; Westboro, Mass., 6.12 in.; Spring Garden, Tenn., 6.00 in.

*Small Monthly Rain-falls*.—At Fort Lyon, Col., Vail, Iowa, and Fort Hartsuff, Neb., none; Fort Union, N. M., trace; Fort Griffin, Tex., 0.02 in.; Sydney Barracks, Neb., 0.06 in.; Yuma, A. T., 0.06 in.; Cheyenne, Wy. Ty., 0.13 in.; Omaha, Neb., 0.14 in.; Plattsmouth, Neb., 0.15 in.; Fort McPherson, Neb. and Tabor, Iowa, 0.16 in.; De Soto and North Platte, Neb. and Breckenridge, Minn., 0.18 in.; Boonsboro, Iowa, 0.20 in.; Fort Pembina, D. T. and Norfolk, Neb., 0.21 in.; Clear Creek, Neb., 0.25 in.

*Floods*.—Valley of the Sacramento, Cal.—During the latter half of January the Sacramento river gradually rose, reaching 22 ft. 3 in. above low water mark at Sacramento City on the 31st. It continued rising until the 5th of February, 2 a. m., when 24 ft. 11 in. was recorded, being one inch higher than any previous record, (highest heretofore 24 ft. 10 in., March, 1876.) Between 2.30 and 3 a. m. a break occurred in the levee on east bank of river, about one mile below Sacramento City, flooding an immense track of country in Sacramento county, and, by backing up, flooded all the southern portion of city on the 6th. After the 6th the river gradually fell until the 12th, when it commenced rising, the water being backed by the high southeast gales during the night of the 12th and 13th. At 3 p. m., 13th, 23 feet 11 in. was re-



corded. During the 12th the Washington river also rose, owing to a heavy snow and rain storm in the mountains. By this time the flood had spread over a great portion of Yolo Co., and the water on the 11th was within three miles of Woodland, forming a vast lake to the north and south. On the 13th it extended eighteen miles below Sacramento. On the 14th the water fell somewhat, but rose again on the 15th, reaching 24 ft. 1 inch, at noon of the 15th, 16th and 17th. On the 17th very heavy rains fell in the Upper Sacramento valley and heavy snows on the mountains, and during the afternoon the river rose at the rate of one foot per hour at Red Bluff; at 9 p. m., 24 feet above low-water mark was recorded and still rising at midnight; numerous breaks occurred in the levees on the Yolo side of the river, and 100 feet of the Sacramento Valley railroad track was washed away at Lexington Crossing. On the 18th the water again rose at Sacramento city, and the upward tendency continued until 7:40 p. m. of the 20th, when 25 feet 11½ inches was recorded, the water reaching Front-street railroad track, and being the highest ever known. By 2:45 p. m. it had fallen to 24 ft. 8 in., and the decline continued to end of month. At noon of the 20th the levee below Washington gave way, and on the 21st the town was almost totally inundated, houses were swept away, and the crevasses in Yolo county exceeded six miles in extent. Extensive overflows also occurred in Colusa county, and in Sutter county a track of country, 15 to 20 miles long and 8 miles wide, was covered to an average depth of 4 to 6 feet. On the 21st the levees protecting the islands in the delta of the Sacramento gave way, and Andros, Brannan and Grand islands were almost entirely submerged, with immense loss of property. At the close of the month reports from Sacramento say the whole of Sacramento valley, on both sides of the river, for a distance of 150 miles, is under water, excepting a few well-guarded cities and towns. In Washington the streets were still several feet under water, and houses were being undermined and careening over. A report from Camanche, Calaveras Co., Cal., says that on the 17th, 4:30 p. m., during a heavy rain-storm, a cloud burst in the hills south of here; four funnel-shaped clouds were observed passing in a northeasterly direction, apparently accompanied by heavy precipitation. Soon the slopes of the hills were covered with torrents of water. In a few minutes a bank of water, several feet in height, swept down Comanche creek, flooding flats on either side, carrying away houses, etc., and drowning ten persons in Chinatown. On the 22nd, at Meriden, Conn., flats along Harbor Brook completely submerged; streets flooded; heavy freshet in Moshansuck river, flooding northern portion of Providence, R. I. Tioga river very high at Elmira, N. Y.; lower portion of city flooded. At Port Hope and Oshawa, Ontario, severe floods also occurred.

*Hail.*—4th, Lenoir, N. C.; 6th, Visalia, Cal., Galveston; 7th, Santa Fe, N. M., Augusta, Forsyth, Ga.; 9th, Nashville, Jacksonville, Mayport, Fla., Danville, Ky., West Waterville, Me., Wytheville, Va.; 10th, Knoxville, Norfolk, Cape Henry, McPherson Bks., Ga., Ft. Independence, Mass., Springfield, Mass., Weldon, N. C., Wytheville, Va.; 13th, Visalia, Cal., Santa Cruz, Cal., Brockhaven, Miss., Fayette, Miss., 15th, Montgomery, St. Marks; 18th, Salt Lake City; 19th, McKavitt, Tex., stones one inch in diameter, Davenport, Elmira and Genessee, Ill.; 20th, Mobile, Independence, Kan., Baxter Springs, Kan., Brockhaven, Miss., Wappingers Falls, N. Y., Clarksville, Tex.; 21st, Highlands, N. C., McMinnville, Tenn.; 22nd, Cornish, Me., West Waterville, Me., Standish, Me., Springfield, Mass., Westboro, Mass., Flatonia, Tex., Woodstock, Vt., Mt. Charlotte, Vt.; 23rd, Mt. Desert, Me.; 25th, Sandy Springs, Md.; 26th, Ft. McHenry, Md., Santa Cruz, Cal., Creswell, Kan., and at Laredo, Tex., stones ¼ inch in diameter; 28th, Santa Fe, N. M.

*Sleet.*—1st, Woods Holl, New London; 8th, Davenport, Detroit; 9th, Oswego, Erie, Indianapolis, Bangor, Me., Detroit; 10th, New Haven, Conn., Boston, Ft. Independence, Mass., West Point, N. Y.; 12th, Cresco, Iowa; 13th, Keokuk, McPherson Bks., Ga.; 14th, Davenport, Oregon, Mo.; 16th, Cleveland, Cresco, Iowa; 18th, Auburn, N. H.; 19th, Detroit; 20th, South Pueblo, Cal.; 21st, Dubuque; 22nd, Eastport, Newbury, Vt., Boston, Cornish, Me., Rowe, Mass., Westboro, Mass.; 23rd, Bangor, Me., Plattsburg Bks., N. Y., Cresco, Iowa; 24th, Cresco, Iowa;

*Depth of snow at close of month.*—In New England, ½ to 15 inches; on summit of Mt. Washington, 40 in.; in the Middle Atlantic States, 0.50 to 4 in.; in the Upper Lakes, 0.25 to 3 in.; Indiana, 0.25 in.; Kansas, 2.50 in.; Summit, Col., 50 in.; Pike's Peak, 24 in.; Bismarck, a trace; Salt Lake City, 1 in.; Santa Fe, N. M., 2 in.

*Rainy days.*—The number of days on which rain or snow has fallen averages as follows: New England, 5 to 13; Middle Atlantic States, 2 to 14; South Atlantic States, 8 to 15; East Gulf States, 5 to 8; West Gulf States, 3 to 8; Lower Lake region, 14 to 20; Upper Lake region, 7 to 15; Upper Mississippi valley, 3 to 16; Lower Missouri valley, 4 to 10; Tennessee and the Ohio valley, 2 to 15; Northwest, 2 to 7; Rock Mountain region, 7 to 19; California, 14 to 21.

*Cloudy days.*—New England, 4 to 12; Middle Atlantic States, 5 to 22; South Atlantic States, 4 to 18; East Gulf States, 0 to 14; West Gulf States, 0 to 7; Lower Lake region, 11 to 16; Upper Lake region, 8 to 17; Upper Mississippi valley, 8 to 14; Lower Missouri valley, 5 to 14; Tennessee and the Ohio valley, 13 to 18; Northwest, 9 to 15; Rocky Mountain region, 2 to 14; California, 9 to 15.

*Precipitation from a cloudless sky.*—At Summit, Col., on 3rd, as snow. At Vevay, Ind., 8th, as rain.

## RELATIVE HUMIDITY.

The average percentage of relative humidity for the month ranges about as follows: New England, 64 to 82; Middle Atlantic States, 57 to 81; South Atlantic States, 67 to 80; East Gulf States, 63 to 75; West Gulf States, 64 to 72; Lower Lake region, 67 to 80; Upper Lake region, 63 to 82; Tennessee and the Ohio valley, 64 to 74; Upper Mississippi valley, 62 to 72; Lower Missouri valley, 65 to 75; California coast, 69 to 75; Sacramento valley, 78 to 80. High stations report the following monthly average percentages not

corrected for elevation: Mt. Washington, 76, 7; Pike's Peak, 63, 7; Cheyenne, 48, 4; Denver, 44, 4; Salt Lake City, 66, 2; Boise City, 67, 5 and Winnemucca, 68, 9.

## WINDS.

*In General*—The prevailing winds, at the Signal Service stations, are shown by arrows on chart No. II. By reference to this chart it will be noticed that the prevailing direction east of the Appalachian Mountains is northwest, except along the immediate South Atlantic coast where more northerly or northeasterly winds prevail; while west of the mountains from eastern Tennessee to the Lower Lakes the prevailing directions are from west to south; in the Upper Lake region and Mississippi valley and thence west to the Rocky Mountains the prevailing direction is northerly, except in Dakota and Montana, where south-east to southwest winds prevail; in the Pacific coast States, southerly to easterly winds predominate, except at Los Angeles and San Diego, which record north and northwest winds.

*Total Movements of the Air*.—The following are the largest monthly movements, as recorded at the Signal Service stations, viz: Pike's Peak, 15,890 miles; Cape Lookout, 11,221 miles; Cape May, 10,612 miles; Thatcher's Island, 10,543; Sandy Hook, 10,279; Indianola, 10,057; Barnegat, 9,146; Cape Henry, 9,093; Cape Hatteras, 8,779; Stockton, 8,602; Dodge City, 8,283; Sandusky, 8,182; Red Bluff, 8,120; Eastport, 7,891 miles.

*The smallest are*: Deadwood, 1830 miles; Lynchburg, 2133 miles; Visalia, 2134 miles; Springfield, 2588 miles; Knoxville, 2605; Augusta, 2717 miles; Nashville, 3246 miles; Salt Lake City, 3568 miles; Cincinnati, 3769 miles; Pittsburgh, 3777 miles; Dubuque, 3865 miles; Boise City, 3877 miles. At Mount Washington a continuous record is not kept, but velocities over 100 miles per hour were recorded on five days.

*Local Storms, Tornadoes &c.*, have occurred as follows: It is to be understood that the high winds, generally accompanying extensive areas of low pressure have already been noticed. 8th, Augusta, Georgia, about 1 a. m. a tornado struck the city in the southwest portion and travelled towards the northeast; its track was about three hundred yards wide and the destruction of property along its course quite large; it was preceded on the evening of the 7th, at 7 p. m., by a thunder-storm, with hail. In referring to this thunder-storm, the observer at Augusta says: "Subsequent investigations of the tornado that followed this storm have lead me to believe that this thunder-storm was an accompaniment of a tornado that devastated portions of Richmond and Burke counties, to the south of this station; about 7:30 p. m. the clouds seemed to be driven towards the east with great velocity, and whirling and rolling furiously; the edge of the clouds nearest the sky was ragged, as if torn by a whirlwind; I could hear during the intervals of thunder a continual roaring sound, like a strong wind in a forest." On the same day (the 8th.) at 7 A.M. a second tornado passed over Fayetteville, N. C., with a waterspout resembling a funnel shaped column of smoke. It moved from SW. to NE., at about 25 miles per hour, and rose and fell, coming to the earth every 800 or 1,000 yards, and while down took trees, fences and houses in its path. It was accompanied with a sound like distant thunder and about  $\frac{1}{4}$  inch rain-fall lasting 15 minutes. A third tornado is also reported on the same day by the schooner "Pride of the East" between Capes Hatteras and Lookout, lasting one hour, with hail and rain. On the 9th, in the vicinity of Jacksonville, Fla., at 3 a. m., "a tremendous wind followed by hail and rain" is reported. 21st, Laconia, Ind., 4 p. m., tornado from SW. width of track 50 or 60 yards, duration from one to two minutes, was accompanied by heavy rain and thunder, and did considerable damage to houses, trees and fences.

## VERIFICATIONS.

*Indications*.—The detailed comparison of the tri-daily weather indications with the telegraphic reports for the succeeding twenty-four hours, shows a general per centage of omissions of 0.2 per cent., and of verifications of 86.1 per cent. The percentages of verifications for the four elements have been; Weather 89.6 per cent.; Wind, 83.6 per cent.; Barometer, 85.6 per cent.; The percentages of verifications by geographical districts have been; New England, 86.8; Middle Atlantic States, 88.7; South Atlantic States, 85.8; East Gulf States, 84.8; West Gulf States, 87.5; Lower Lake Region, 87.7; Upper Lake Region, 86.3; Tennessee and the Ohio Valley, 85.6; Upper Mississippi Valley, 85.3; Lower Missouri Valley, 83.7. Of the 3,352 predictions that have been made 53 or 1.6 per cent, are considered to have entirely failed; 103 or 3.1 per cent., were one-fourth verified; 433 or 12.9 per cent., were half verified; 450 or 13.4 per cent., were three-fourths verified; 2,313 or 69.0 per cent., were fully verified so far as can be judged from the weather maps.

*Cautionary Signals*.—During the past month 139 Cautionary Signals have been displayed at 34 stations on the Gulf and Atlantic coasts and on Lake Michigan; of which, 120, or 86.3 per cent., were reported verified within one hundred miles of the station. One signal was ordered up late. Thirty-nine cases of winds, of 25 miles or over, per hour, have also been reported at these stations, for which no signals were displayed.

## NAVIGATION.

*Stages of Water in Rivers*.—In the table on chart No. III are given the highest and lowest readings, for the month, on the Signal Service river-gauges, from which it will be seen that the danger line on gauge has not been reached at any of the stations mentioned, and that the nearest approach to it occurred at Shreve-



port and Vicksburg. In the Lower Mississippi the lowest readings were recorded during the early part of the month, and the highest on the 27th and 28th.

*Ice in Rivers and Harbors.*—The following items will serve to show the conditions of the rivers and harbors in this respect: The Missouri, at Yankton, was frozen over until the 20th, when the ice broke, and the river has since continued open; at Omaha the ice broke on the 15th and 16th, and on the 19th the river was open for navigation; at Leavenworth it remained open throughout month. The Mississippi remained frozen over at St. Paul until the 28th, when the ice broke up and moved out; at La Crosse it remained closed until the 7th, when it commenced breaking up in the channel; on the 10th and 16th floating ice passed down from the La Crosse river, and from the 20th to 22nd shore ice gave way, and ferry-boat commenced running; Guttenburg, 2nd, river frozen over; 17th, clear; at Dubuque the ice broke up from 5th to 7th; on the 19th river was full of floating ice, but the observer states that "local navigation was practically uninterrupted during the month;" at Davenport, 1st to 4th, 9th to 12th and the 17th, floating ice; at Keokuk, on the 3d, the river was clear; 10th, slush ice; 12th, clear; Muscatine, 5th, ice in river 9 in.; 19th, clear. On the *Lakes* ice is reported as follows: Duluth, 28th, ice in bay broken up by high winds. Marquette, 5th, ice in harbor broke up; 10th, ice formed; 13th, broke up; 15th, formed; 21st, broke up. Escanaba, ice in bay throughout month. Chicago, 1st to 25th, lake frozen; 26th, shore ice floating off. Grand Haven, 12th, river frozen over. Alpena, river frozen throughout month; 10th, bay entirely clear of ice; 18th, frozen over; 23rd, clear. Detroit, 1st and 3rd, river frozen; 4th, ice broke up. Toledo, 1st to 21st, Maumee river frozen over; 22nd, broke up and cleared away from dock; at 2:45 p. m., an immense field of ice came down sweeping away span of new railroad bridge. Cleveland, 1st to 25th, floating ice. Buffalo, 1st to 23rd, river frozen; 24th, broke up; 28th, river and harbor clear. Fort Niagara, 1st, river full of floating ice; 9th, clear. Sebago Lake, Me., 28th, 15 inches ice in lower bay, "upper bay only frozen over one day this winter." Lake Champlain, at West Charlotte, Vt., 7th, partly frozen; 8th, ice all gone, except in bays; 15th, much floating ice. The Hudson river, at Wappinger's Falls, 4th, firm; 20th, ice 10 inches thick; 26th, ice spongy; 27th, ice moving; 28th, river open to Poughkeepsie, navigation resumed. Albany, 28th, ice breaking up. West Point, 27th, first steamer passed up river. Ardenia, river open throughout month. Rockford, Ill., 5th, river clear; 11th, frozen over; 14th, clear. Morristown, Dak., 28th, "James river nearly open." New London, Conn., 14th, Thames river full of floating ice from Shetucket.

## TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, is shown in table on chart No. III.

*Maximum and Minimum Temperatures.*—The highest maxima have been: 65° at St. Marks, 63° at Galveston and Jacksonville, 56° at Augusta, Montgomery and Savannah, and 55° at Charleston and Mobile. The lowest minima have been: 29° at Portland, Me., 30° at Keokuk, 31° at Wood's Holl and New York city, and 32° at Sandusky.

*Ranges of Temperature.*—The least have been: 1° at Detroit and Duluth, 2° at Eastport and Grand Haven, 3° at Milwaukee, and 4° at Charleston, New London, Sandusky and Wilmington. The largest: 12° at Galveston, 11° at Keokuk, Montgomery and St. Louis, and 10° at St. Marks.

## ATMOSPHERIC ELECTRICITY.

*Thunder-Storms.*—4th, Tex.; 6, Tex., La.; 7th, Fla., Ala., Ga., La., S. C.; 8th, Ala., N. C., Miss., Va.; 9th, Fla., Tenn., Ga., Ala., Ind., Ky., Ohio; 10th, Va.; 12th, Tex.; 13th, Cal., Miss., Ala.; 14th, Fla., La.; 15th, Fla.; 17th, Ga., N. C.; 19th, Tex., Iowa, Ill., Mo.; 20th, Ind. Ty., Kan., Tex., Miss., Ala., Tenn., Ark., La., Mo., Ohio; 21st, Ala., Tenn., Ky., S. C., Fla., Ga., Ind., Mo., N. C., Ohio, Pa.; 22d, Md., N. J., N. Y., Pa., Tex., Va.; 23d, Fla., Md.; 24th, Kan., N. C.; 26th, Fla., Tex.; 27th, Fla.; 28th, N. M., Neb., Kan., Ga.

*Distant Lightning.*—On the 7th at N. C., Fla., and Ga.; 9th, N. C.; 21st, N. C. and Ga.; 22nd, Tex., N. C. and Md.; 27th, Col.; 28th, Col.

*Auroras.*—On the 5th at Cornish and Orono, Me., Contoocookville and Mt. Washington, N. H.; 12th, Creco, Iowa; 19th, Atco, N. J.; 26th, Escanaba and Alpena, Mich.; 27th, Albany, N. Y.; 26th, during sand-storm at Visalia, Cal., electricity intense; 28th, Santa Fe, atmospheric electricity intense, interfering with working of line. Pike's Peak, the assistant on station at summit, in ascending the mountain encountered severe electric storm at timber line, in which his hair crackled, and he experienced a severe burning sensation all over the head.

*Magnetic Phenomena.*—The average diurnal magnetic range in declination, is again reported by Prof. Hinrichs, of Iowa City, as 4½ minutes.

## OPTICAL PHENOMENA.

*Solar Halos.*—2nd, Dak., Iowa, Kan.; 3rd, Ill., Iowa, Mich.; 4th, Conn.; 5th, Mich., Pa., La., Iowa, Fla.; 6th, Dak., Iowa, Neb., Ga., Vt.; 7th, Iowa, Neb., Ohio, Wis.; 8th, N. H., Wis., Cal., Col.; 9th, Iowa, Mich., Wis., Cal.; 10th, Ill., Iowa, Neb., Cal., Mich.; 11th, Ill., Ind., Iowa, Mich., Neb., Wis., Ohio, R. I., Mass.; 12th, Conn., N. H., Ohio, Tenn., Ala., La., Fla., Ga., R. I.; 13th, Ill., Ind., Iowa, Ohio, W. Va.; 14th, Ill., Ind., Mich., N. Y., Ky.; 15th, Conn., Ind., Me., Mass., N. H., N. Y., Vt., Tex.; 16th, Conn., Mo.,

N. H., N. Y., Dak.; 17th, Me., Md., Ky., N. C.; 18th, Md., Dak.; 19th, Ill., Ind., Me., Mich., N. Y., Ohio, Ky.; 20th, Neb., Ill., Iowa, Me., Ohio, Tenn., Wis., Dak., Ga.; 21st, Neb., N. J., Ohio, Col.; 22nd, Iowa, Kan.; 23rd, Cal., Kan.; 24th, Ohio; 25th, Conn., Ind. Ty., Tex., R. I.; 26th, Col., Kan., Tex., Ga.; 27th, Mo., N. C., Ga.; 28th, Conn., Iowa, Mass., Neb., N. Y. Kan., Ga., R. I.

*Lunar Halos*.—1st, Mich.; 2nd, Mass., Neb.; 3rd, Mich.; 4th, Neb.; 6th, Ark., Me., N. H.; 7th, Can., Ill., Iowa, Md., Mich., N. J., Va., Wis., Neb., Mo., N. Y., Ky., Conn.; 8th, Ind., Minn., N. J., Wis., Tex., Mich., Vt., Mass.; 9th, Dak., Iowa, Mass., Mich., Minn., Neb., N. J., Pa., Wis., Cal., Kan., N. C., Ga., S. C.; 10th, Neb., Ill., Iowa, Mo., Ohio, Wis., N. M., Mass.; 11th, Ill., Ind., Md., Mass., Mo., Neb., N. H., N. Y., N. C., Ohio, Pa., Vt., Wis., Dak., Tex., Iowa, Mich., Tenn., R. I., Me., Conn.; 12th, Neb., Conn., Ill., Iowa, Kan., Ky., Me., Mass., N. H., N. Y., N. C., Wis., Nev., Col., Miss., Ala., Minn., Ohio, Tenn., Fla., Ga., S. C., Me., R. I.; 13th, Ind., Iowa, Kan., N. J., N. Y., Ohio, Pa., Vt., Wis., Cal., Col., Minn., Ill., Mich., Ky., Mass., Conn.; 14th, Mich., Conn., Ind., Iowa, Miss., N. J., N. Y., Ohio, Vt., Va., Wis.; 15th, Can., Conn., Ind., Me., Mass., Neb., N. J., N. Y., Tex., Mich., N. C., N. H., R. I., Vt., 16th, Dak., Ill., Ind, Kan., Ky., Me., Mass., Mich., Miss., Mo., N. H., N. J., N. Y., N. C., Ohio, Vt., Cal., Neb., Ala., Minn., Tenn., Va., Me., R. I., Conn.; 17th, Ill., Mass., Cal., Neb., Mo., Conn.; 18th, Ill., Iowa, Kan., Miss., Ala., La., N. Y., N. H., Mass.; 19th, Ill., Ind., Mass., Va., Ga., Conn.; 20th, Me., Nev., Mass.; 21st, S. C., 23rd, Cal.

*Mirage*.—Olivet, Dak.; 4th, Baxter Springs, Kan.; 28th, Moorhead, Minn., 1st and 2d; Genoa, Neb., 4th, Tybee Island, Ga., 11th, New London, 3d and 19th.

## MISCELLANEOUS PHENOMENA.

**BOTANICAL**.—Alabama—Green Spring, peach trees in bloom, 23rd. Arkansas—Judsonia, spring beauties, maples and daffodils blooming, 17th; wild forget-me-nots and peach trees in bloom, 22nd. California—Visalia, peach trees in full bloom, 22nd; Sacramento, almond and peach trees in bloom several weeks; trees leafing. Connecticut—New London, crocus blooming, 25th. Dakota—Olivet, weeds and grass sprouting, 28th. Florida—Houston, peach trees and rose bushes in bloom, 12th, crocuses and hyacinths in bloom 28th; plum trees in bloom, 24th; Milton, plum trees in bloom, 28th; peach trees in bloom, 24th. Illinois—Havana, scilla siberica blooming, 25th; soft maples in bloom, 20th. Iowa—Fort Madison, peonies, horse radish and calamus sprouting, 7th; elder trees budding, cherry and peach buds swelling, and blackberry buds bursting, 17th. Kansas—Cresswell, peach buds swelling 23rd, wheat growing finely; 25th Empire City, snowdrop and crocus in bloom 12th, liverwort in bloom 13th; Independence, Addertongue in bloom 25th, willow leafing 22nd, soft maple blooming 27th, peaches, cherries and plums nearly in bloom 28th, wheat growing the entire month Baxter Springs, roses and honey suckles leafing 27th; Holton, forest trees budding 28th; Lawrence, maples in bloom 16th.—Mississippi, Brookhaven, maple trees and jessamine blooming, hickory buds swelling 24th; Vicksburg, peach trees blooming 24th.—Michigan, Litchfield, maple sap running 28th.—Louisiana, New Orleans, orange trees budding 27th. Missouri—Lebanon, cherries budding, peach buds fully formed, 28th. Oregon, maple trees budding, 6th. New Hampshire—Mill Village, maple sap running well, 28th. New Jersey—Vineland, cottonwood and maple buds swelling, 9th. Ohio—Ruggles, wheat green, maple-trees budding, 28th; Ringgold, wheat and fruit prospects good, 28th. Pennsylvania—Chambersburg, crocus and snow-drops in bloom, 21st. Tennessee—McMinnville, forest trees budding, iris and spirea blooming, 23d. Maryland—New Market, purple grackle first seen, 27th. Sandy Springs, wheat growing, flowers in bloom, 28th. Texas—Clarksville, peach and plum trees in bloom; Belmont Farm, wild flowers in bloom, 17th, peach and almond trees in bloom, 19th; Austin, garden vegetables abundant, flowers in bloom, all fruit trees in bloom, 28th; Graham, prairie violets in bloom, 17th. Virginia—Alto Vista, elder bushes budding, 22d; Prospect Hill, daffodils in bloom, 22d, hyacinths in bloom, 14th; Wytheville, aspens budding, 8th, pruning and transplanting, 28th. West Virginia—Morgantown, trees budding, 24th. Wisconsin—Rocky Run, willows budding, 4th.

**BIRDS**.—*Blackbirds*, Southington, Conn., 28th; Elmira, Ill., 23rd; Great Bend, Kan., 28th; Fallston, Md., 23rd; Mendon, Mass., 28th; Fayette, Miss., 1st, 7th; Bethel, Ohio, 24th. *Bullfinch*s, Oregon, Mo., 26th. *Bluebirds*, Judsonia, Ark., 6th; Southington, Conn., 2nd, 5th, 8th, 12th, 22nd, 24th to 28th; Elmira, Ill., 25th; Hennepin, Ill., 27th; Sandwich, Ill., 28th; Havana, Ill., 3rd; Louisville, Ill., 17th; Fort Madison, Iowa, 20th; Guttenburg, Iowa, 27th; Empire City, Kan., 13th; Independence, Kan., 28th; Afton, Iowa, 25th; Muscatine, Iowa, 25th; Boonsboro', Iowa, 27th; Stanley, Kan., 17th; Holton, Kan., 17th; Mendon, Mass., 28th; Fort Gibson, Ind. Ty., 19th; Davenport, Iowa, 20th; Somerset, Mass., 24th; Fall River, Mass., 23rd; Northport, Mich., 28th; Litchfield, Mich., 25th; Oregon, Mo., 5th; Plattsmouth, Neb., 15th; Starky, N. Y., 25th; Flushing, N. Y., 17th; Murphy, N. C., 10th; Highlands, N. C., 7th; Bellefontaine, Ohio, 24th; Little Mountain, Ohio, 22nd; Bethel, Ohio, 13th; Jacksonburg, Ohio, 15th; Mt. Auburn, Ohio, 24th; *Robins*, Elmira, N. Y., 22nd; Sandwich, Ill., 21st; Havana, Ill., 3rd; Milford, Ind., 24th; Fort Madison, Iowa, 20th; Empire City, Kan., 15th; Independence, Kan., 28th; Boonsboro', Iowa, 27th; Holton, Kan., 19th; Fort Gibson, Ind. Ty., 14th; Somerset, Mass., 19th; Fall River, Mass., 28th; Litchfield, Mich., 1st; Oregon, Mo., 19th; Freehold, N. J., 8th and 23rd; Starky, N. Y., 28th; Bellefontaine, Ohio, 19th; Little Mountain, Ohio, 22nd; Bethel, Ohio, 13th; Jacksonburg, Ohio, 21st; Mt. Auburn, Ohio, 7th; Ringgold, Ohio, 21st; Brownsville, Pa., 21st; Lynchburg, Va., 28th. *Ducks*, Judsonia, Ark., 5th and 6th; Olivet, Dak., 20th; Elmira, Ill., 25th; Milford, Ind., 22nd; Guttenburg, Iowa, 18th; Cresswell, Kan.,

3rd, 11th, 14th, 23rd; Muscatine, Iowa, 25th; Vail, Iowa, 19th; Great Bend, Kan., 6th; Dubuque, 20th; Oregon, Mo., 7th, 13th and 18th; Emerson, Nebraska, 20th; Jacksonburg, Ohio, 18th. *Crows*, Monticello, Iowa, 5th; Bethel, Ohio, 13; Ringgold, Ohio, 9th. *Killdeer*, Ft. Madison, Iowa, 19th; Milford, Del., 22nd; Baxter Springs, Kan., 16th; Fallston, Md., 23rd. *Pigeons*, Fayette, Miss., 12th; Jacksonburg, Ohio, 18th. *Phebe birds*, Plattsmouth, Neb., 23rd; Somerset, Mass., 8th. *Buzzards*, Jacksonburg, Ohio, 25th. *Geese*, flying N., Sandwich, Ill., 23rd; Elmira, Ill., 25th; Augusta, Ill., 17th; Mt. Sterling, Ill., 28th; Laconia, Ind., 9th; Milford, Ind., 22nd; Monticello, Iowa, 19th; Guttenburg, Iowa, 19th; Creswell, Kan., 16th; Independence, Kan., 27th; Vail, Iowa, 18th; Nora Springs, Iowa, 19th; Visalia, Cal., 21st; Fort Gibson, Ind. Ty., 14th; Dubuque, 28th; Emerson, Neb., 20th; Flushing, N. Y., 10th; flying W., Mt. Sterling, Ill., 16th; flying S., Fort Madison, Iowa, 7th; Centre Mound, Kan., 21st; Somerset, Mass., 19th; flying. NE., Fort Madison, Iowa, 2nd; Holton, Kan., 13th; NW., Los Angeles, Cal., 6th. *Meadow Larks*—Hennepin, Ill., 27th; Nora Springs, Iowa, 14th; Centre Mound, Kan., 28th; Great Bend, Kan., 28th; Bellefontaine, Ohio, 24th. *Chickadee*—Monticello, Iowa, 3rd and 10th. *Woodpeckers*—Monticello, Iowa, 4th. *English Sparrows*—New Market, Md., 21st; Somerset, Mass., 24th; Northport, Mich., 28th; Flushing, N. Y., 4th. *Blue jays*, Guttenburg, Iowa, 27th; Muscatine, Iowa, 25th; Oregon, Mo., 5th. *Red Birds*, Oregon, Mo., 5th; Brookhaven, Miss., 25th. *Owls*, Oregon, Mo., 10th, 11th, 15th, 16th. *Mocking Birds*, Houston, Tex., 14th; Independence, Kan., 17th; Savannah, Ill., 24th. *Prairie Chickens*, Hermepin, Ill., 28th; Monticello, Iowa, 27th; Creswell, Kan., 27th.

**MISCELLANEOUS.**—*Frogs* piping at Judsonia, Ark., 15th; Milford, Del., 22nd; Guttenburg, Iowa, 20th; Baxter Springs, Kan., 5th and 6th; Creswell, Kan., 2nd and 21st; Stanley, Kan., 17th; Independence, Kan., 18th; Fallston, Md., 21st; Sandy Springs, Md., 21st; Fort Gibson, Ind. Ter., 13th; Fayette, Miss., 1st, 6th and 14th; Howard, Neb., 18th; Alto Vista, Va., 1st; Prospect Hill, Va., 8th. *Earth-worms*, Lawrence, Kan., 28th; Oregon, Mo., 23rd. *Bees*, Milford, Ind., 20th; Guttenburg, Iowa, 6th; Afton, Iowa, 26th; Savannah, 24th; Chambersburg, Pa., 27th. *Caterpillars*, Monticello, Iowa, 28th; Tioga, Pa., 27th. *Lizards*, Austin, Tenn., 13th. *Millers*, Ft. Madison, Iowa, 6th. *Butterflies*, Guttenburg, Iowa, 5th; Savannah, 24th; Fayette, Miss., 8th and 16th. *Moths*, Guttenburg, Iowa, 5th; Oregon, Nev., 25th and 26th. *Mosquitos*, Fort Madison, Iowa, 28th; Independence, Kan., 24th to 28th. *Grasshoppers*, Guttenburg, Iowa, plentiful, 26th; Bonsboro, Iowa, 7th.

*Polar Bands.*—7th, Ind.; 8th, Miss, Iowa, N. H.; 10th, Iowa; 12th, Va.; 13th, Iowa; 16th, Mo.; 17th, N. H.; 18th, Miss., Neb.; 19th, Ind.; 21st, Mo., Neb.; 26th, Vt.; 27th, Ind.; 28th, Ind, Neb., Va.

*Sunsets.*—The characteristics of the sky as indicative of fair or foul weather for the succeeding 24 hours, have been observed at all Signal Service stations. Reports from 107 stations show 2,942 observations to have been taken, of which 2,539, or 86.3 per cent., were followed by the expected weather. Fifty-three doubtful cases were reported.

*Prairie Fires*—1st, Ind. Ty.; 2nd, Ind. Ty., Dak.; 3rd, Ind. Ty., Minn.; 4th, Minn., Kan.; 5th, Kan.; 6th, Dak., Minn.; 7th, Minn.; 8th, Minn.; 9th, Minn.; 10th, Minn.; 16th, Kan.; 18th, Kan.; 19th, Kan.; 21st, Kan.; 22nd, Ind. Ty.; 23rd, Ind. Ty., Dak., Kan.; 24th, Dak., Kan.; 25th, Ind. Ty., Kan.; 26th, Ind. Ty., Dak., Iowa, Kan.; 27th, Ind. Ty., Tex., Dak., Kan.; 28th, Dak., Kan.

*Meteors.*—3rd, Westchester, Pa.; 4th, Monticello, Iowa, Woodstock, Md., Flatonia, Tex.; 5th, Mobile; 6th, Woodstock, Md., Westerville, Ohio; 7th, St. Mary's Home, Ind., Somerset, Mass.; 9th, Ft. Pembina, Dak.; 12th, Fall River, Mass., Dunbarton, N. H.; 15th, Chepachet, R. I.; 16th, Chepachet, R. I.; 18th, St. Mary's Home, Ind., 12st, Flatonia, Tex.; 22nd, New Orleans; 24th, Kensico, N. Y.; 25th, Woodstock, Md., Kensico, N. Y., Mt. Auburn, Ohio; 26th, Woodstock, Md.; 27th, Corning, Mo., Freehold, N. J.; 28th, Woodstock, Md., Freehold, N. J.; 19th, Cincinnati, 10:15 p. m., a meteor shot through the clouds and moved from SW. to NE. It was very luminous, and small particles continually fell from it.

*Zodiacal Lights.*—Southington, Conn., 3d, 4th, 5th, 26th to 28th; Daytona, Fla., 1st, 4th, 19th to 26th; Como, Ill., 2nd; St. Mary's Home, Ind., 3d, 7th, 18th, 26th to 28th; Iowa City, Iowa, 1st to 4th, 19th, 27th, 28th; Monticello, Iowa, 1st, 2nd, 4th, 22nd to 26th; Great Bend, Kans., 25th; Okaloosa, La., 18th; Cornish, Me., 5th, 19th, 20th; Somerset, Mass., 2nd, 3d, 4th, 5th, 18th, 19th, 24th to 28th; Cambridge, Mass., 2nd to 5th, 18th to 19th, 24th to 28th; Corning, Mo., 23d to 27th; Oregon, Mo., 2nd, 21st to 23d, 25th to 28th; Clear Creek, Neb., 2nd, 19th, 21st, 23d, 25th, 26th; Freehold, N. J., 26th to 28th; Atco, N. J., 3d, 4th, 5th, 26th to 28th; Moriches, N. Y., 25th; Waterburg, N. Y., 4th, 18th; Bellefontaine, Ohio, 18th, 28th; Williamsport, Pa., 28th; Wytheville Va., 5th, 19th, 27th, 28th; Savannah, 1st; Tybee Island, Ga., 23d, 24th; Newburg, Vt., 2nd, 19th, 26th, 27th; Olivet, Dak., every night.

*Earthquakes.*—Records recently received from Coban, Guatemala, contain the following accounts: July 13th, 1877, 5:15 a. m., thirteen or fourteen shocks, direction E. to W.; 20th, 10:05 a. m., two slight shocks, E. to W.; 27th, 8 p. m., slight shock, lasting a few seconds. August 27th, 11:35 a. m., three shocks from N. September 10th, 10:45 a. m., two shocks, lasting seven seconds; the façade of church of San Sabastian swayed to and fro noticeably. November 21st, 10:16 a. m., two vertical shocks; 10:37 p. m., a number of small shocks, the first vertical, the last apparently from SW., duration forty seconds; 26th, 9:57 a. m., a few vertical shocks, repeating quickly, lasting twenty seconds. From Iquique, Peru, January 23d, 1878, 7:50 p. m., strong shock, lasting thirty seconds. "Shock appears to have been much greater in the interior, and many factories had to suspend work." Arica, Peru, January 23d, 8:10 p. m., "very severe and prolonged shock, followed by slighter shocks throughout night." Iquique, January 24th, 8:30 p. m., heavy shock,



followed by lighter shocks during night, and on the 25th, every fifteen minutes; "roads obstructed, and shipping operations paralyzed for three days." On the 5th of the present month, 11:20 a. m., Flushing, N. Y., severe shock, shaking houses and breaking crockery and windows. 26th, 11:56 a. m., San Francisco, California, three vibrations, N. to S., lasting about five seconds.

*Tidal Wave.*—At Callao, Peru, S. A., Jan. 27th, "sea excessively rough all day, the waves washed with violence along the whole sea front of town and for about two miles on either side, causing great destruction of property; flooded whole of English railroad station and streets adjoining; wet dock badly damaged; all forts fronting on sea suffered; the Ayacucho battery nearly washed away."

### SOLAR PHENOMENA.

*Sun spots.*—The following observations, made by Mr. D. P. Todd, have been communicated by Rear Admiral John Rogers, U. S. N., Superintendent of the Naval Observatory.

Feb., 1878.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
3d, 3 p. m...	2	14	0	0	—	—	2	14	
4th, 11 a. m...	0	12	0	0	0	0	2	26	Many of the spots very small.
5th, 10 a. m...	0	4	0	0	0	0	2	30	Many of the spots very small.
6th, 2 p. m...	0	5	0	0	0	0	2	35	Many of the spots very small.
7th, 3 p. m...	0	0	0	10	0	0	2	25	Most of the spots small.
12th, 1 p. m...	0	0	—	—	0	0	0	0	Spots probably disappeared by solar rotation.
16th, 12 m...	0	0	0	0	0	0	0	0	
18th, 1 p. m...	1	0	0	0	0	0	0	0	
19th, 12 m...	0	0	0	0	0	0	0	0	
20th, 12 m...	0	0	0	0	0	0	0	0	
25th, 3 p. m...	0	0	0	0	0	0	0	0	
26th, 3 p. m...	0	0	0	0	0	0	0	0	
27th, 11 a. m...	0	0	0	0	0	0	0	0	Large group of faculae.
28th, 11 a. m...	0	0	0	0	0	0	0	0	Large group of faculae.

Prof. Hinrichs, of Iowa City, reports on the 3rd, 1 group, 7 spots, two very large size; 4th, 2 groups, 12 spots; 5th, 2 groups, 12 spots; 6th, 2 groups, 9 spots; on the other days of observation, viz: the 11th, 12th, 19th, 26th 27th and 28th, no spots were observed.

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*Albert J. Myer*

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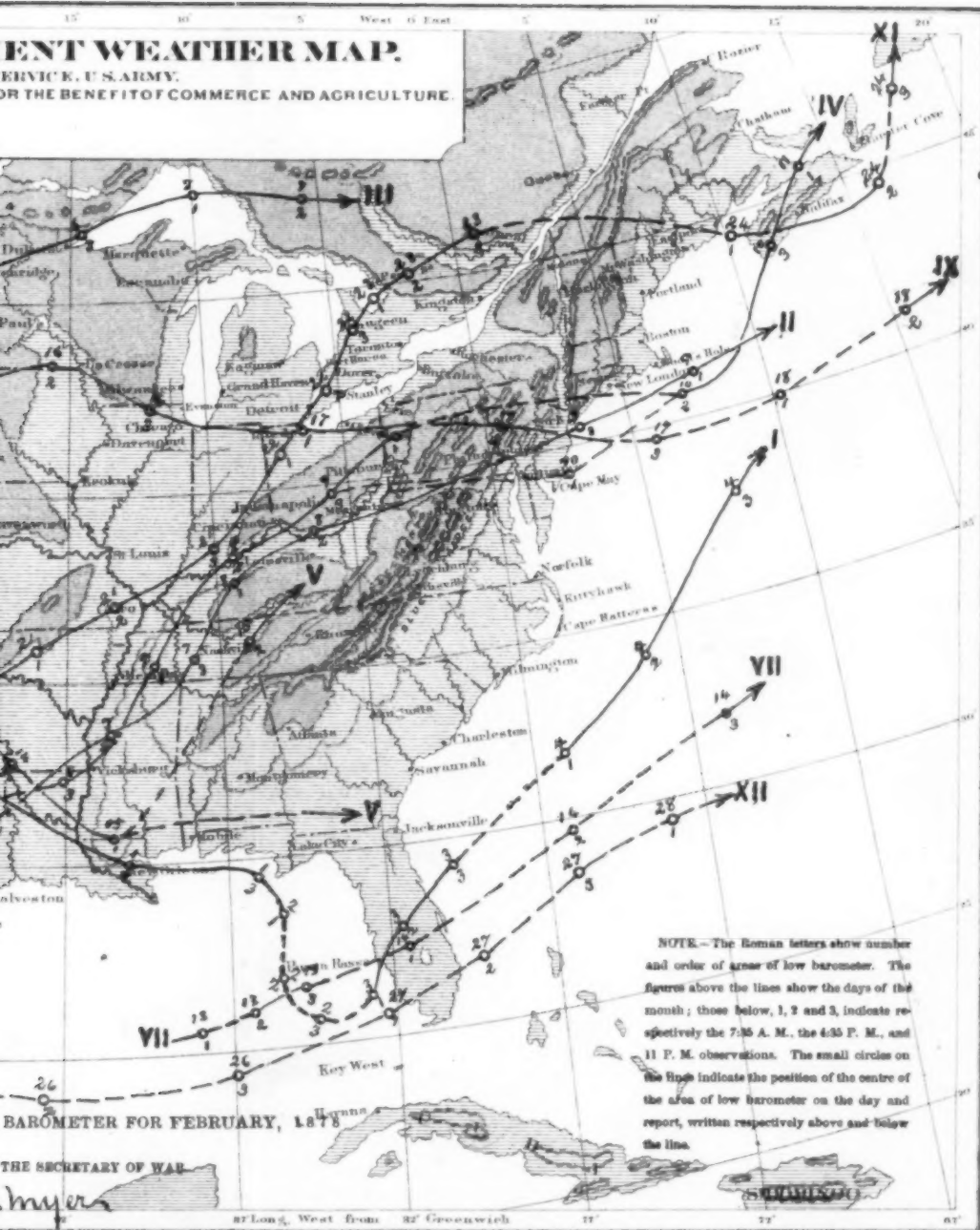
*Brig. Gen. (Bvt. Assg<sup>d</sup>.) Chief Signal Officer, U. S. A.*





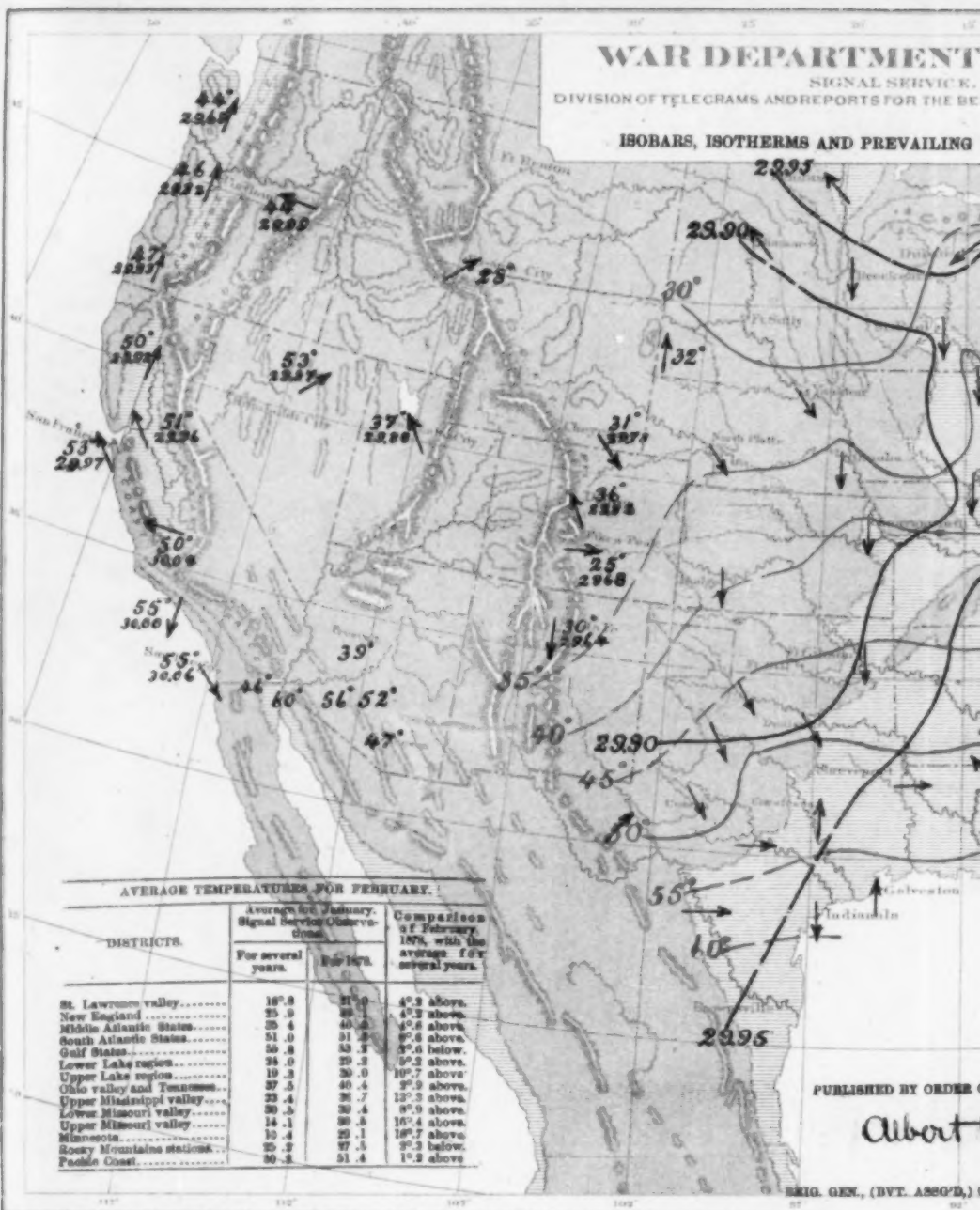


**WENT WEATHER MAP.**  
SERVICE, U. S. ARMY.  
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.



# WAR DEPARTMENT SIGNAL SERVICE DIVISION OF TELEGRAMS AND REPORTS FOR THE BE

## ISOBARS, ISOTHERMS AND PREVAILING



### AVERAGE TEMPERATURES FOR FEBRUARY.

DISTRICTS.	Average for January. Signal Service Observations		Comparison of February, 1878, with the average for several years.
	For several years.	For 1878.	
St. Lawrence valley.....	16°.8	21°.0	4°·2 above.
New England.....	25°.9	30°.1	4°·2 above.
Middle Atlantic States.....	35°.4	40°.2	4°·8 above.
South Atlantic States.....	51°.0	51°.8	°·8 above.
Gulf States.....	56°.8	53°.3	3°·5 below.
Lower Lake region.....	34°.0	29°.3	4°·7 above.
Upper Lake region.....	19°.3	30°.0	10°·7 above.
Ohio valley and Tennessee.....	37°.5	40°.4	2°·9 above.
Upper Mississippi valley.....	33°.4	36°.7	3°·3 above.
Lower Missouri valley.....	30°.5	30°.4	°·9 above.
Upper Missouri valley.....	14°.1	30°.8	16°·4 above.
Minnesota.....	19°.4	29°.1	9°·7 above.
Rocky Mountains station.....	25°.3	27°.5	2°·2 below.
Pacific Coast.....	30°.3	31°.4	1°·2 above.

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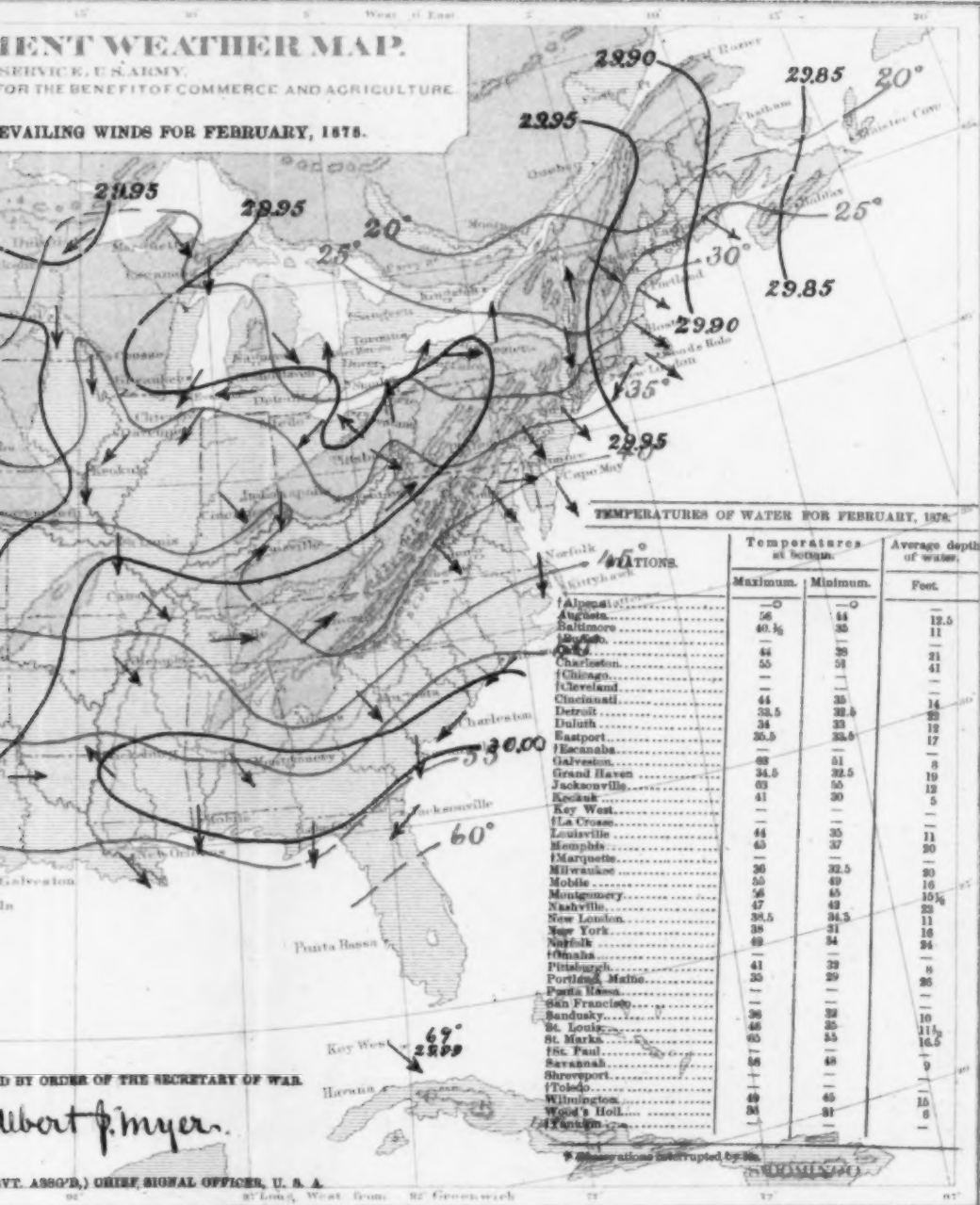
BRIG. GEN., (BVT. ASST. Q.)

# No. II.

## IENT WEATHER MAP.

SERVICE, U. S. ARMY.  
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

AVAILING WINDS FOR FEBRUARY, 1878.



BY ORDER OF THE SECRETARY OF WAR.

Albert J. Meyer.

(VT. 1880'D.) CHIEF SIGNAL OFFICER, U. S. A.

87° 30' West from 82° Greenwich



# WAR DEPARTMENT WE

## SIGNAL SERVICE U.S.A.R.

### DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF

#### PRECIPITATION CHART FOR FEBRU

#### AVERAGE PRECIPITATION FOR FEBRUARY

DISTRICTS	Average for February		Comparison of February, 1917, with the average for many years
	For many years.	1917	
	inches.	inches.	
St Lawrence valley.....	3.08	1.70	1.38 deficiency.
New England.....	3.10	2.21	0.89 excess.
Middle Atlantic States.....	3.45	2.93	0.52 deficiency.
South Atlantic States.....	3.35	3.11	0.24 deficiency.
Eastern Gulf States.....	4.25	3.51	0.74 deficiency.
Western Gulf States.....	3.80	3.68	0.12 deficiency.
Lower Lake region.....	2.80	2.98	0.18 excess.
Upper Lake region.....	1.75	1.79	0.04 deficiency.
Tennessee.....	3.33	1.90	1.43 deficiency.
Ohio Valley.....	4.91	2.73	2.18 deficiency.
Upper Mississippi Valley.....	1.50	1.67	0.17 deficiency.
Lower Missouri Valley.....	1.58	1.59	0.01 deficiency.
Minnesota.....	0.70	0.98	0.28 deficiency.
California Coast.....	2.55	8.47	5.92 excess.
Portland, Or.....	6.99	12.16	5.17 excess.

PUBLISHED BY ORDER OF THE SECRETARY

Albert J. Myer.

AND GEN. (BVT, ASST'D) CHIEF SIGNAL OFFICER

# No. III.

15° Latitude from W. Washington 5° West of East 5° 10° 15° 20°

**WEATHER MAP.**  
 U.S. ARMY.  
 BENEFIT OF COMMERCE AND AGRICULTURE.  
 FOR FEBRUARY, 1878.

